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Cammack et al.

[11] **3,808,972**

[45] **May 7, 1974**

[54] **DUAL FUNCTION BOMB**

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[21] Appl. No.: **880,459**

[52] **U.S. Cl.** **102/7.2,** 102/7.4, 102/74, 102/81.2

[51] **Int. Cl.** **F42b 25/16**

[58] **Field of Search** 102/2, 7.2, 70, 74, 8, 102/56

[56] **References Cited**

UNITED STATES PATENTS

1,237,909	8/1917	Isham	102/74
1,317,608	9/1919	Barlow	102/7.2
1,751,616	3/1930	Brayton	102/74
3,195,459	7/1965	Reed, Jr.	102/7.2
3,416,449	12/1968	Brothers	102/56

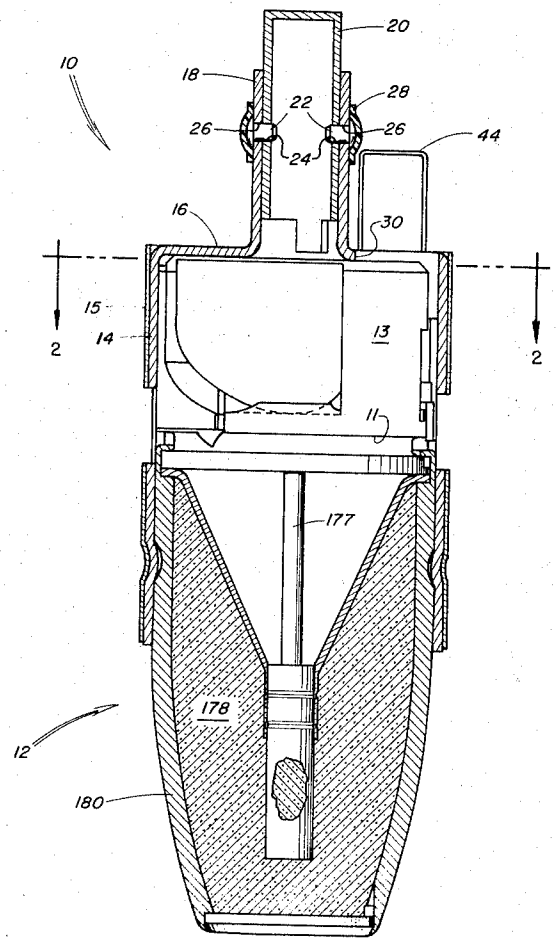
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Attorney, Agent, or Firm—R. S. Sciascia; J. A. Cooke; J. M. Neary

[57] **ABSTRACT**

A dual function bomb combining anti-personnel and armor piercing capabilities in a single bomb and capable of discriminating between targets. A frangible member in the bomb nose shears upon impact with a hard target, such as armor, and drives a firing pin into a detonator in an arming rotor to cause instantaneous initiation of an armor piercing shaped charge. Impact with soft targets, such as earth, will not shear the frangible member but causes an inertia firing pin to initiate a propellant charge and a pyrotechnic delay. The propellant charge ejects the warhead upward three to ten feet at which time the pyrotechnic delay initiates the shaped charge for optimum effect against unprotected personnel in the vicinity.

10 Claims, 11 Drawing Figures



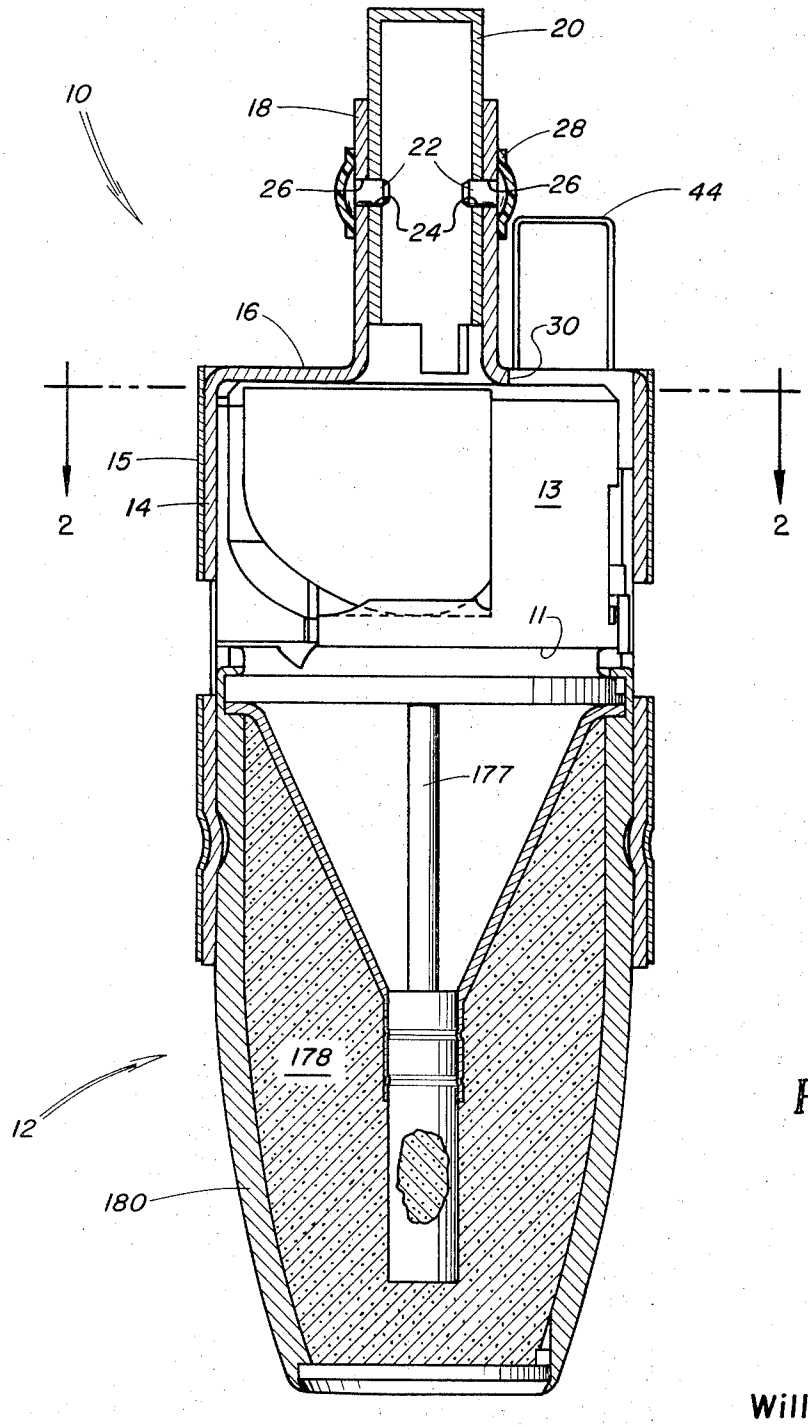


FIG. 1

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ATTORNEY

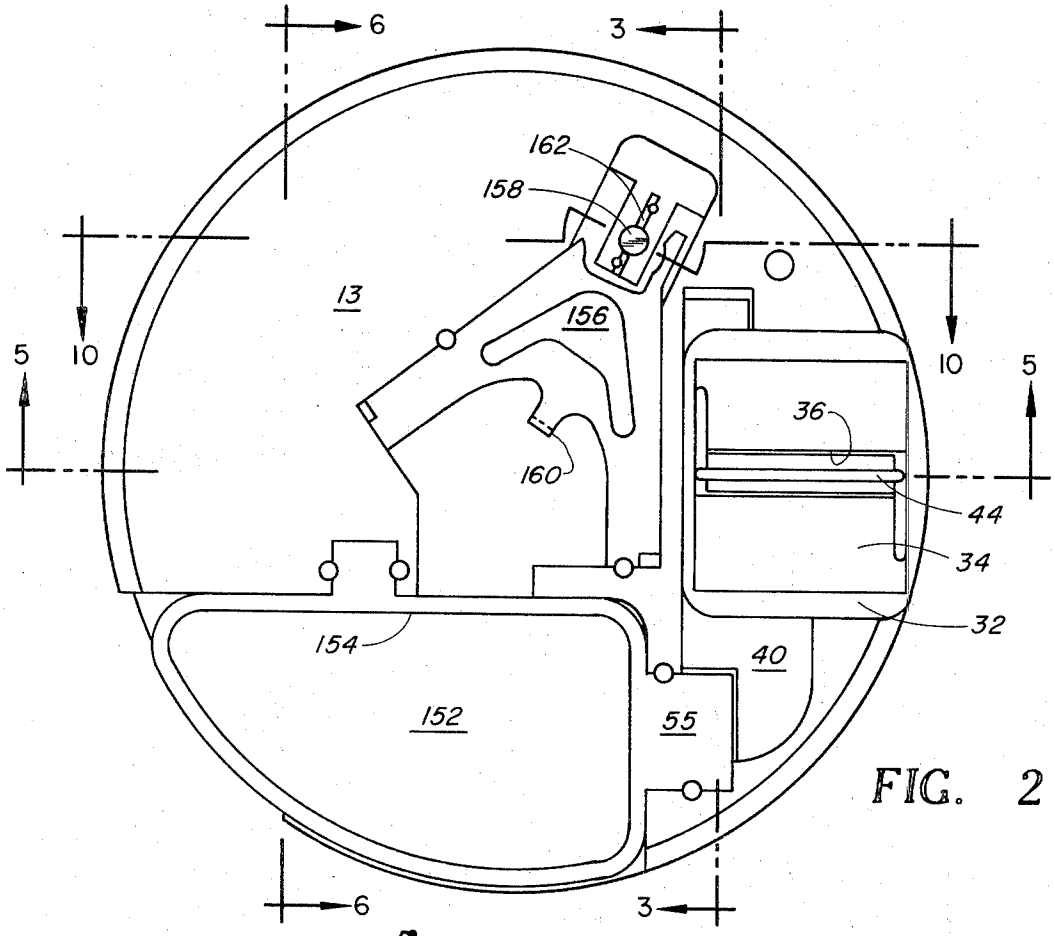

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FIG. 2

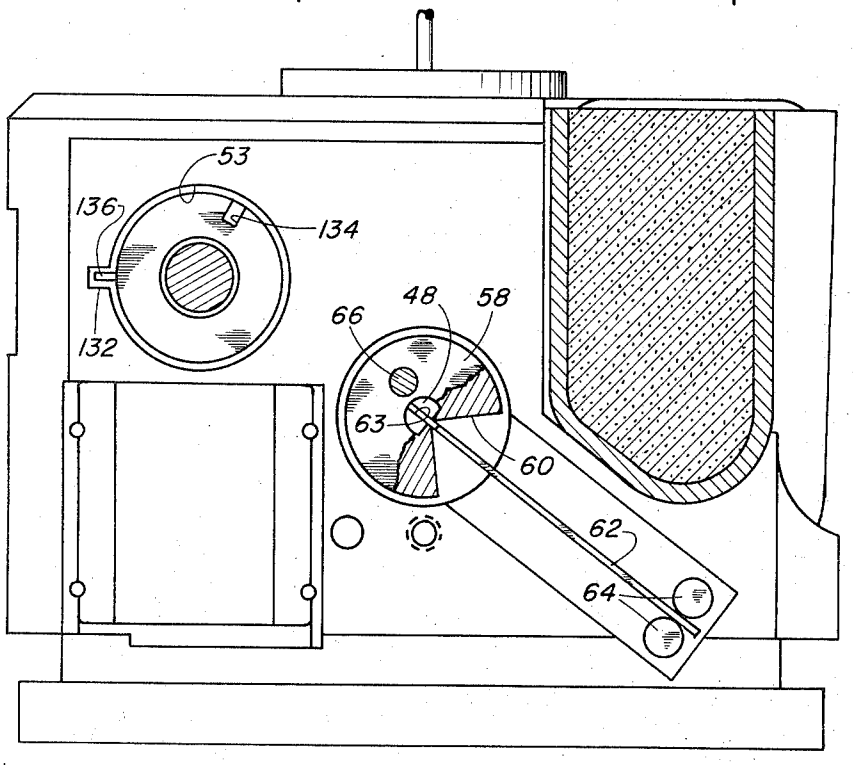

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FIG. 6

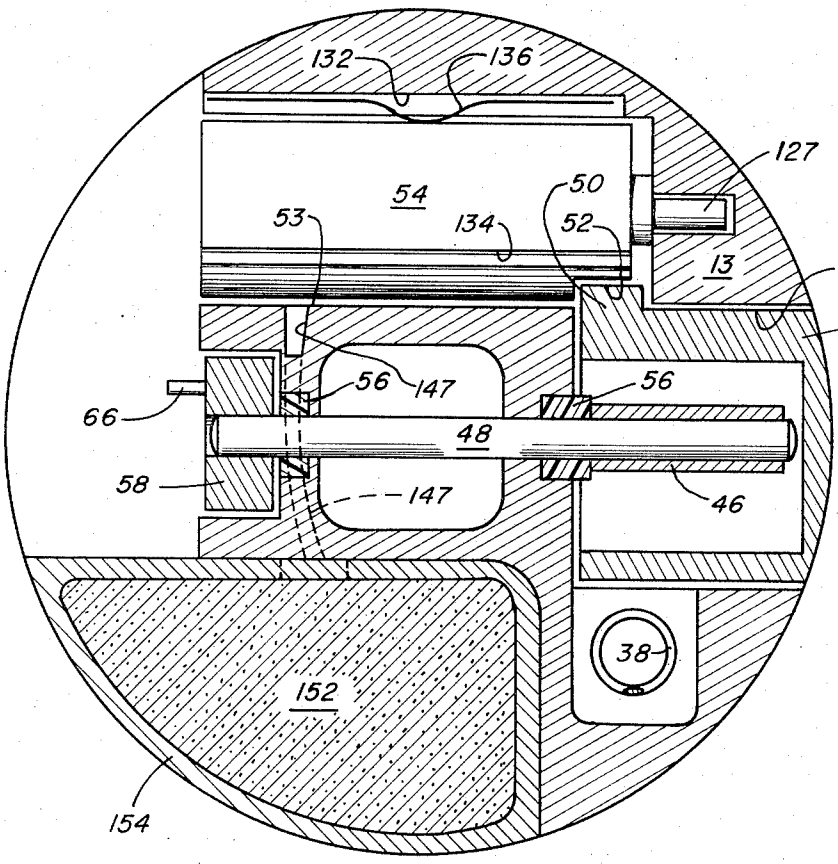

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FIG. 4

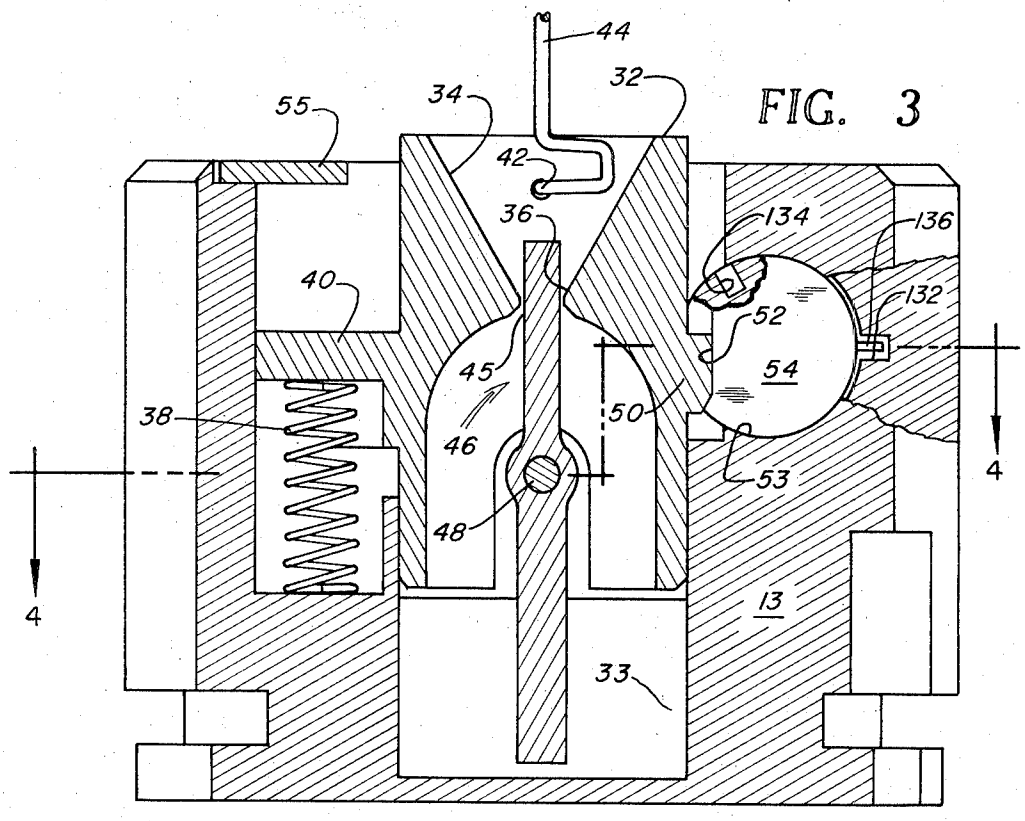

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FIG. 3

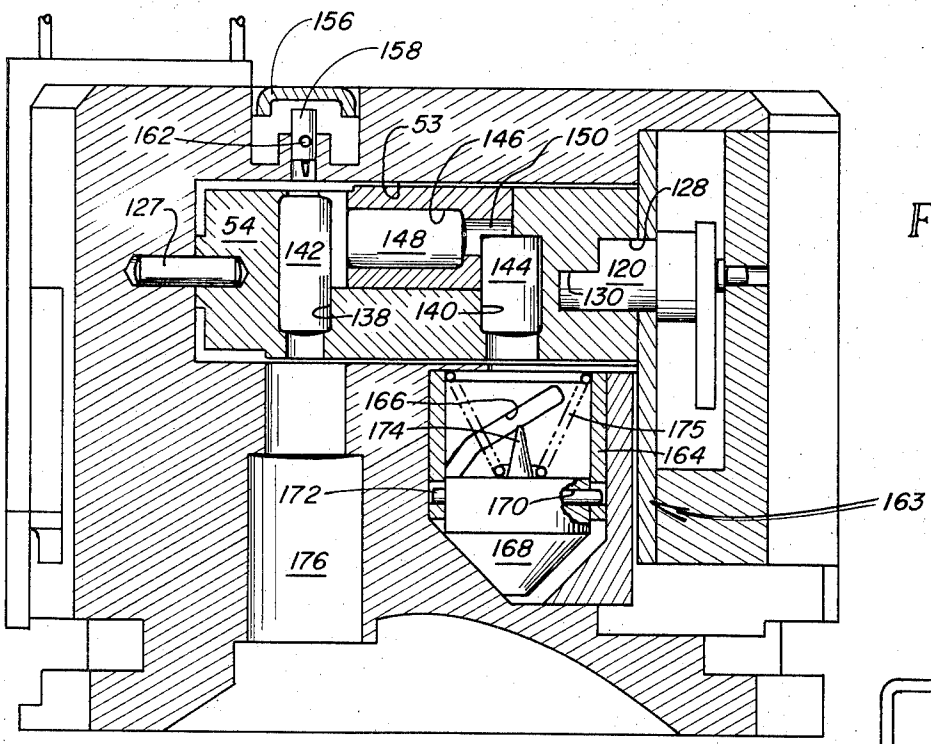

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FIG. 10

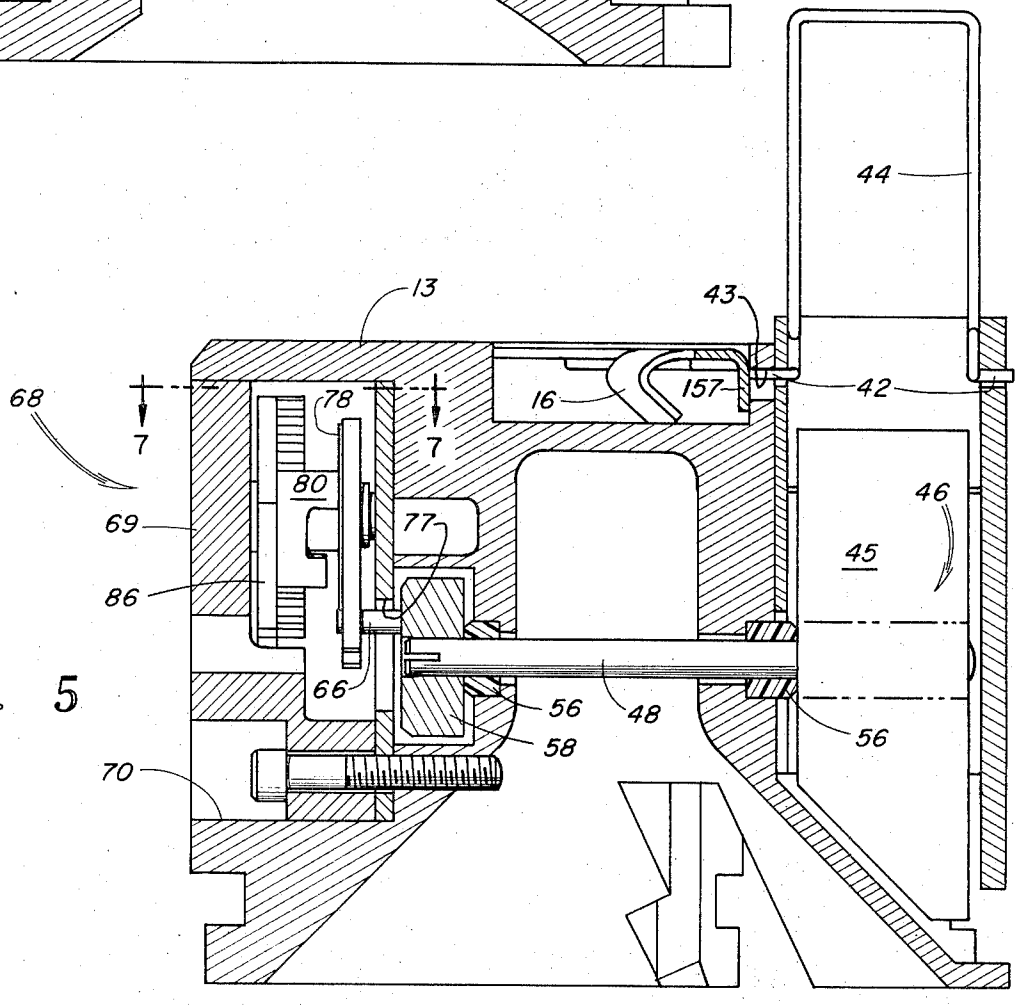

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FIG. 5

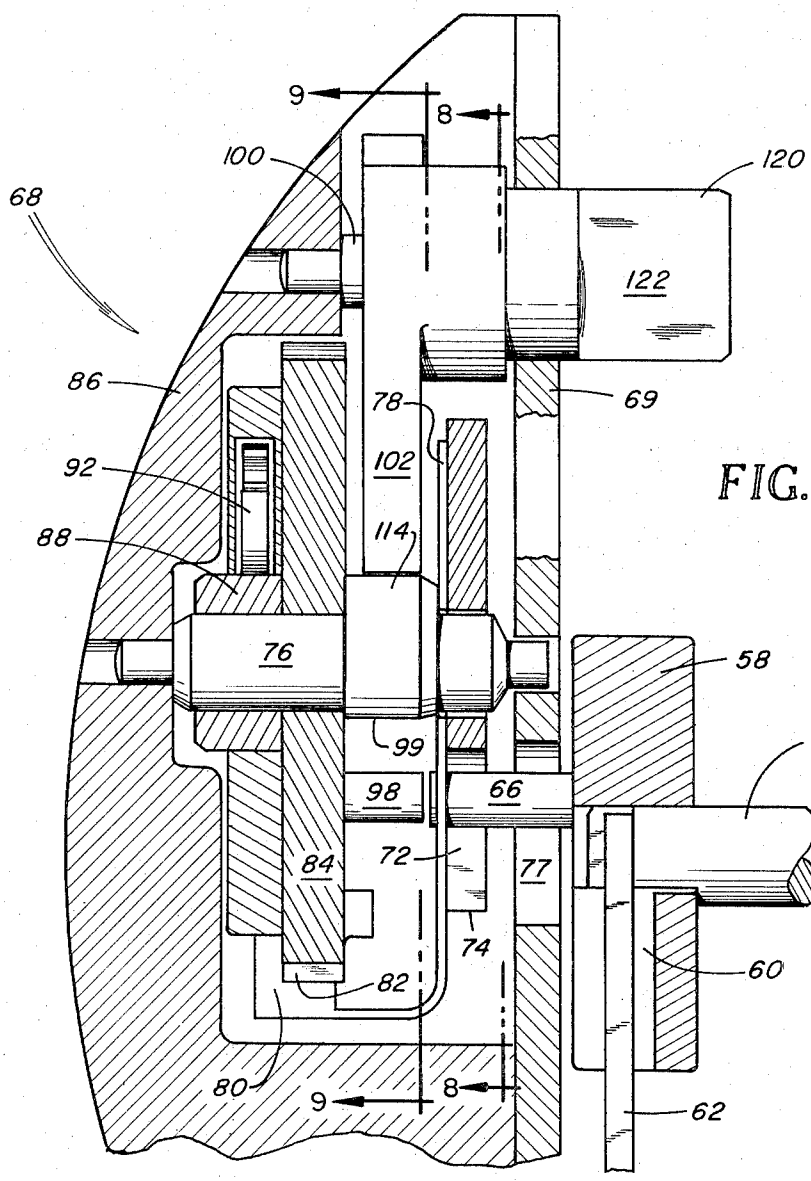

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FIG. 7

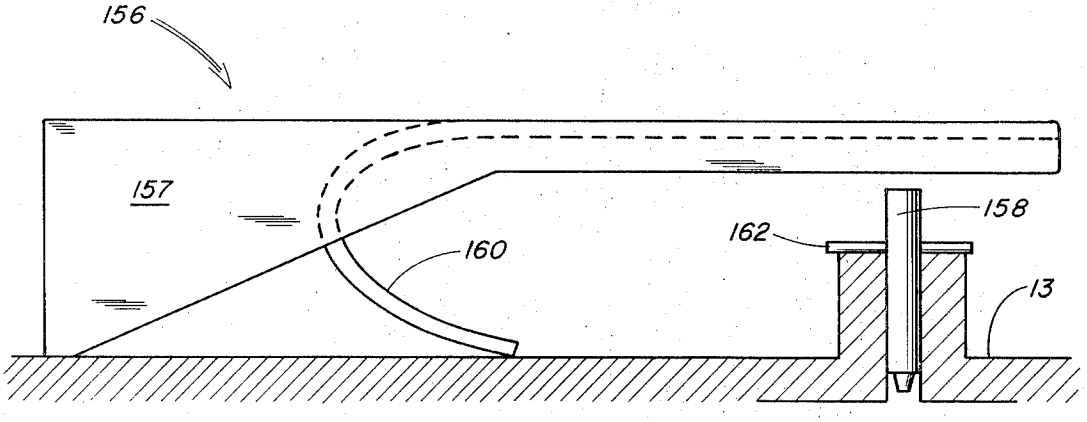

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FIG. 11

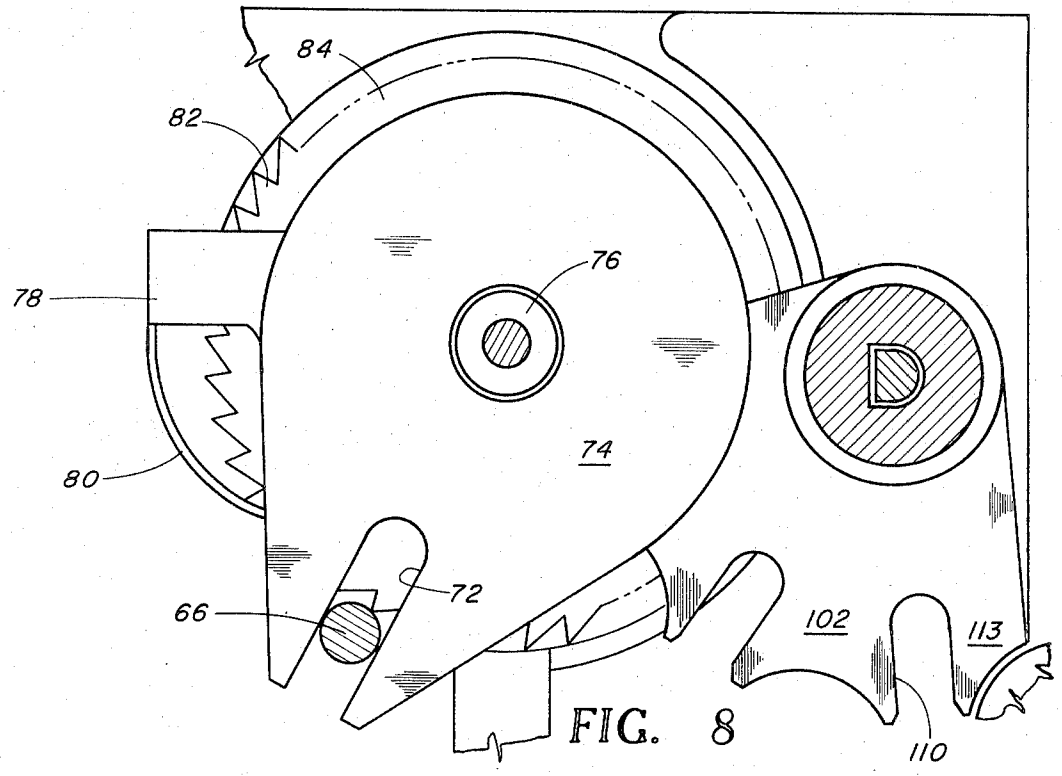

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FIG. 8

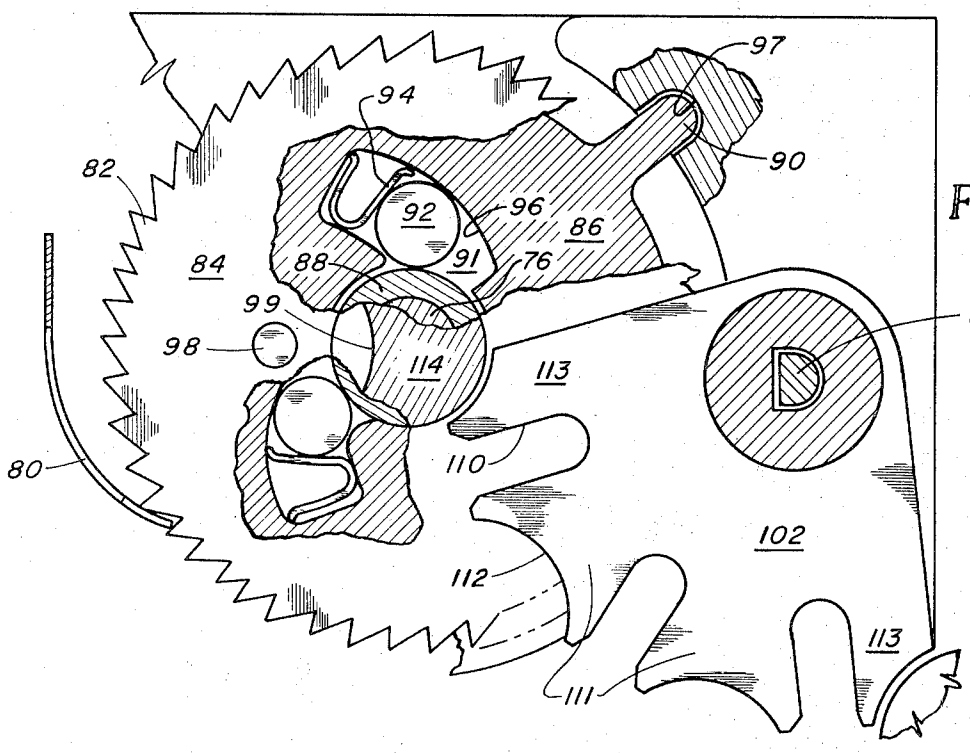

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FIG. 9

DUAL FUNCTION BOMB

BACKGROUND OF THE INVENTION

This invention relates generally to ordnance fuzes, and more particularly to an environmentally armed mechanical ordnance fuze for a dual function bomb.

Modern ordnance is designed for maximum effectiveness against specific classes of targets. There presently exist bombs that are specifically designed for use against armor or other hardened fortifications. These ordnance devices generally employ a shaped charge and a fuze designed to initiate the shaped charge at the instant of impact so that the jet from the detonating shaped charge is directed against whatever article the bomb happens to impact against, be it armor plate, hardened fortifications, or soft earth. In the event of impact against the soft earth, the jet from the exploding shaped charge is directed harmlessly into the earth and the destructive effect of the ordnance device to the surrounding area is minimal.

There exists also another class of ordnance devices specifically designed for use against personnel. These devices are designed to detonate a proximate distance above the target to achieve the maximum possible destructive effect against light structures and unprotected personnel. However, these air burst devices are generally ineffective against hardened fortifications unless they contain an immense quantity of explosive.

The type of ordnance device selected for use in a particular mission depends on the class of target anticipated to be encountered during the mission. If it is anticipated that armor or hardened fortifications will be encountered, ordnance of the first class is selected; if it is anticipated that only light structures or personnel will be the target, ordnance of the second class is selected and used. This procedure necessarily restricts the flexibility of the mission by limiting the options of the attackers. For example, if the anticipated target was hardened fortifications or armor, the ordnance selected would be of the first class and if during the attack a large attractive target of light structures or unprotected personnel was discovered in an area of soft earth such as a field, the shaped charge contact detonation ordnance would be relatively ineffective against this target for the reasons stated. Similarly, if hardened fortifications or armor were encountered on a mission armed with proximity air burst ordnance, the opportunity for an immediate attack of optimum effectiveness would be lost.

An attack against a mixed target of unprotected personnel and hardened targets such as armor or reinforced fortifications presents a dilemma to the attacker. If he selects the air burst proximity ordnance for optimum effect against the personnel, the armor is immune to his attack. If he selects the shaped charge contact detonation ordnance for use against the armor, the personnel are relatively immune.

For these and other reasons, the need has long existed for an ordnance device which produces an instantaneous shaped charge detonation against hard targets, or, if no hard target is struck, produces an air burst detonation against unprotected targets.

SUMMARY OF THE INVENTION

Accordingly, one object of this invention is to provide an ordnance fuze combining air burst against soft targets and instantaneous shaped charge detonation against hardened targets.

Another object of the invention is to provide a low cost, environmentally armed ordnance fuze for a compact, dual function bomb.

Still another object of the present invention is to provide a low cost lightweight fuze of high reliability for a dual purpose bomb.

A further object of the present invention is to provide a mechanical fuze for a shaped charge bomb which does not disturb the aerodynamic properties of the bomb and which does not interfere with the passage of the jet from the shaped charge.

Briefly, in accordance with one embodiment of this invention, these and other objects are attained by providing a flutter vane for a fuze which acts through a drive train to bring a detonator and a primer in an arming rotor into alignment with a pair of firing pins. Impact with a hard target will instantaneously drive one of the firing pins into the detonator and thereby instantaneously initiate a shaped charge in the bomb. Impact with a soft target will not actuate the instantaneous firing pin but rather will cause an inertia firing pin to initiate a primer which in turn initiates a propellant charge to propel the warhead upward a proximate distance above the target level. A delay train, initiated simultaneously with the propellant charge, then detonates the warhead a proximate distance above the target level for maximum destructive effectiveness against unprotected personnel in the vicinity.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and its many attendant advantages will develop as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is an elevational view, partly in section, of a bomb to which the inventive fuze is mated;

FIG. 2 is a sectional view along lines 2—2 in FIG. 1;

FIG. 3 is a sectional view along lines 3—3 in FIG. 2;

FIG. 4 is a sectional view along lines 4—4 in FIG. 3;

FIG. 5 is a sectional view along lines 5—5 in FIG. 2;

FIG. 6 is a sectional view along lines 6—6 in FIG. 2;

FIG. 7 is a sectional view along lines 7—7 in FIG. 5;

FIG. 8 is a sectional view along lines 8—8 in FIG. 7;

FIG. 9 is a sectional view along lines 9—9 in FIG. 7;

FIG. 10 is a sectional view along lines 10—10 in FIG. 2, but with the arming rotor in armed position; and

FIG. 11 is an elevation of the strike plate and instantaneous firing pin.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference characters designate identical or corresponding parts throughout the several views and more particularly to FIG. 1 thereof wherein a bomb 10 is shown having a rearwardly tapering, generally cylindrical warhead 12

crimped at its forward end into a groove 11 around the rearward end of a base or fuze block 13. Warhead 12 and fuze block 13 fit within a cylindrical mortar barrel 14 surrounded by a sleeve 15. Sleeve 15 has lateral cuts extending from the forward end thereof to facilitate splaying of sleeve 15 on impact with soft earth to prevent undue penetration of the bomb thereinto. A forwardly extending tubular nose 18 protrudes from the forward or leading face 16 of mortar barrel 14, and slidably receives an impact receiving member or striker cup 20. Striker cup 20 is prevented from relative sliding movement in nose 18 by frangible shear rivots 22 which extend through aligned holes 24 and 26 in striker cup 20 and tubular nose 18, respectively. A heat shinkable plastic ferrule 28 surrounds tubular nose 18 and retains shear rivets 22 in position against radially outward movement. Forward face 16 of mortar barrel 14 has formed therethrough an air port 30 for a purpose to be described hereinafter.

Looking now at FIGS. 2, 3 and 4, a nozzle 32 slidably fits within a nozzle cavity 33 formed in fuze block 13 and is aligned with port 30. Nozzle 32 has formed in the forward face thereof a forwardly flaring air intake 34 which terminates rearwardly of the forward face of nozzle 32 in an apex slot 36. A coil spring 38 bears against a ledge 40 formed on one lateral side of nozzle 32 and urges nozzle 32 forwardly for extension through port 30 into the airstream past the falling bomb. Nozzle 32 is restrained from forward movement by a pair of feet 42 best seen in FIG. 5 which extend through lateral holes in the side of nozzle 32, one of which engages a corresponding hole 43 in fuze block 13. Feed 42 constitute the ends of U-shaped shipping and storage retention spring 44, the legs of which may be flexed inwardly to release feet 42 from engagement with fuze block 13 to release nozzle 32 for forward movement under the influence of spring 38 to the limit permitted by engagement of ledge 40 with a shelf 55 extending over ledge 40.

In its rearward position best illustrated in FIG. 3, apex slot 36 engages the leading half 45 of a flutter vane 46 to hold the vane from movement. Vane 46 is mounted rigidly on a shaft 48 which in turn is journaled in Teflon bearings 56. Therefore, when vane 46 is released from engagement with apex slot 36, it is free to rotate with shaft 48 about the axis of shaft 48. On the lateral side of nozzle 32 opposite ledge 40, a lug 50 is formed. Lug 50 has a flat outside surface which engages a complementary flat 52, machined on the periphery of an arming rotor 54 journaled for rotation in a cylindrical cavity 53 in fuze block 13, thereby preventing rotation of arming rotor 54 about its axis. Release of nozzle 32 for movement to its forwardmost position through port 30 accomplishes three functions: it release flutter vane 46, it positions air intake 34 in the airstream past the falling bomb and apex slot 36 in optimum position for directing a flow of air at flutter vane 46, and it releases arming rotor 54 for rotation about its axis from its first or safe position to its second or armed position.

With reference now to FIGS. 5 and 6, flutter vane shaft 48 journaled in bearings 56 has keyed thereto at the end opposite to the end on which is attached flutter vane 46 a disc 48. A 90° sector 60 is cut out of disc 58 and a cantilevered spring 62 extends through sector 60 of disc 58 and is rigidly secured in a slot 63 through the end of shaft 48. A pair of stop pins 64 are mounted on fuze block 13 adjacent to the end of cantilever spring 62 and on both sides thereof. A pin 66 is mounted on the outside lateral face of disc 58 for movement with disc 58.

Before describing the operation of the vane mechanism, it is noted that the bombs 10 are intended to be nested together in clusters within a dispenser for delivery and release over a target area by the dispenser. The shipping and storage retention springs 44 are removed from the bombs when the bombs are loaded into a dispenser, the bombs being packed into the dispenser in such manner that adjacent layers of bombs are interlinked so as to hold each nozzle 32 in its rearward position, holding vane 46 between opening 36 and extension 50 against the flat 52 on rotor 54. When the bombs are released from their dispenser, each nozzle is allowed to move forwardly under the influence of spring 38 to the limit permitted by engagement of ledge 40 with shelf 55. Air is collected by air intake 34 and directed through apex slot 36 against the leading edge 45 of vane 46. This impinging airstream will deflect the vane 46 to one side. Deflection of vane 46 will rotate shaft 48 and disc 58 and deflect cantilever spring 62. The deflection of cantilever spring 62 generates a restoring torque on shaft 48 which, after full deflection of vane 46, rotates shaft 48 and vane 46 in the opposite direction beyond dead center. The impinging airstream directed through apex slot 36 will then deflect the vane 46 fully to that side, and the cycle is repeated. This oscillation of vane 46 produces a periodic arc of travel of pin 66.

A segmental cavity 70 best seen in FIG. 5 is formed in the side of fuze block 13. Fitting within segmental cavity 70 is a transmission 68 contained in a transmission housing 69 of a shape complementary to segmental cavity 70. Transmission 68, best seen in FIGS. 7, 8 and 9, is for the purpose of linking flutter vane 46 to rotor 54 to cause rotation by the former of the latter. The transmission mechanism includes a generally pear-shaped guide disc 74 having a radial slot 72 formed therein and mounted for free rotation about a shaft 76 journaled in transmission housing 69. Pin 66 fixed to disc 58 extends through an aperture 77 in the inner wall of transmission housing 69 and into slot 72 in guide disc 74. Thus, the periodic arc of travel of pin 66 is transmitted to and causes rotational oscillation of disc 74 about shaft 76.

A pawl plate 78 is fixed to the outside face of guide disc 74 for movement therewith. Extending from pawl plate 78 is a pawl arm 80 which engages ratchet teeth 82 formed on the periphery of ratchet wheel 84 which in turn is keyed to shaft 76. Thus, as guide disc 78 is oscillated by engagement with oscillating pin 66, plate 78 and pawl arm 80 will oscillate with the guide disc, in engagement with ratchet wheel 84. As pawl arm 80 oscillates in an arc about and in engagement with ratchet wheel 84, it serially engages teeth 82, advancing ratchet wheel 84 an angular rotation of one tooth for each cycle of oscillation.

As pawl arm 80 is drawn backwards over the sloping portion of ratchet teeth 82 on the rearward stroke of its oscillation, ratchet wheel 84 must be held against rotation to allow pawl arm 80 to engage the next tooth. To accomplish this, shaft 76 to which ratchet wheel 84 is keyed, is prevented from clockwise movement as viewed in FIG. 9 by a sprag mechanism. The sprag mechanism includes a sprag wheel 86 which surrounds

but is rotatable relative to a bushing 88 keyed to shaft 76. As best seen in FIG. 9, sprag wheel 86 has formed therein three cavities 91 spaced equidistant around sprag wheel 86 and communicating with bushing 88. Positioned in cavities 91 are sprag discs 92 urged into engagement with bushing 88 by springs 94. Each cavity 91 has an inside sloping surface 96 which forms with the periphery of bushing 88 a cavity of diminishing dimension. This it is seen from FIG. 9 that as shaft 76 and bushing 88 keyed thereto rotate in a clockwise direction that sprag disc 92 will be rotated into binding engagement with sloping surface 96 and bushing 88, and will therefore prevent the rotation of shaft 76 and bushing 88 relative to sprag wheel 86. A protruding tongue 90 formed on sprag wheel 86 extends into a complementary notch 97 in transmission housing 69 thereby preventing rotation of sprag wheel 86 about shaft 76 and bushing 88. It is seen therefore that clockwise rotation of shaft 76 and bushing 88 is positively prevented by the action of sprag disc 92 turning into the narrow portion of sprag cavities 91 and binding between sloping surface 96 and bushing 88. However, rotation of the shaft 76 and bushing 88 in counterclockwise direction is not hindered by the sprag mechanism because sprag discs 92 will rotate out of engagement with sloping surface 96 and turn freely with bushing 88 in the wide portion of sprag cavity 91.

The operation of the drive mechanism to this point is as follows. The oscillation of pin 66 along its arc of travel causes an angular oscillation of guide disc 74 and the pawl arm 80 connected thereto. Spring pawl arm 80 oscillates in an arc of travel about ratchet wheel 84 in engagement with teeth 82 around the periphery thereof. On the counterclockwise stroke of its oscillation, pawl arm 80 engages one of the teeth 82 and rotates ratchet wheel 84 and shaft 76 keyed thereto in the counterclockwise direction. On the clockwise stroke of its oscillation, pawl arm 84 slides up over the adjacent tooth and drops down into engagement therewith. The tendency for ratchet wheel 84 to turn clockwise with the pawl arm 80 is prevented by the sprag mechanism engaging bushing 88 and shaft 76 to which bushing 88 is keyed. Thus each full oscillation of vane 46 produces through the above transmission mechanism an angular advance of ratchet wheel 84 corresponding to the angular separation of ratchet teeth 82.

A pin 98 is attached to the side of ratchet wheel 84, and angularly aligned with pin 98 a concave cut 99 is formed in the periphery of shaft 76.

Referring again to FIG. 7, a shaft 100 is journaled in the walls of transmission housing 69. Keyed to shaft 100 is a Geneva wheel sector 102, best seen in FIGS. 8 and 9, which constitutes a sector of approximately 120°. Geneva wheel sector 102 includes three radial slots 110 and between them, two full teeth 111 having concave outer surfaces 112. On either side of full teeth 111 are half teeth 113. The radius of curvature of the concave outer surfaces 112 is complementary to the radius of a wide portion 114 of shaft 76. Therefore, when a tooth 111 is aligned with shaft wide portion 114, the engagement of concave outer surface 112 with the periphery of wide portion 114 prevents rotation of Geneva wheel sector 102. As ratchet wheel 84 is indexed around by pawl arm 80, pin 98 attached to the side of ratchet wheel 84 and concave cut 99 formed in the periphery of wide portion 114 of shaft 76 and angularly aligned with pin 98 are presented to Geneva wheel 102. Pin 98 enters and engages a slot 110 and rotates Geneva wheel sector 102 through concave cut 99 the angular distance of one tooth. When tooth 98 has left slot 110 on its counterclockwise path, concave cut 99 is no longer aligned with tooth 111 and concave surface 112 is aligned with wide portion 114 from shaft 76 thereby preventing further rotation of Geneva wheel sector 102 until the next rotation of ratchet wheel 84, pin 98 and concave cut 99. This process is repeated for three rotations of ratchet wheel 84 for a total rotation of 120° of Geneva wheel 102.

The inner end of shaft 100 extends beyond transmission housing 69 and into cylindrical cavity 53 in fuze block 13 wherein arming rotor 54 is journaled. The inner end of shaft 100 is enlarged at 120 and a semicylindrical cut is formed in the end thereof leaving a semicylindrical sector 122. Looking now at FIGS. 4 and 10, arming rotor 54, journaled in cavity 53 by means of an end pin 127, is supported at the other end thereof by enlarged end 120 of Geneva wheel shaft 100. Enlarged end 120 fits into a complementary shaped bore 128 having a semicylindrical portion 130 in the end of arming rotor 54 whereby rotation of shaft 100 will cause rotation of arming rotor 54.

Referring back now to FIGS. 3 and 4, a longitudinal slot 132 is formed in fuze block 13 adjacent and opening into cylindrical cavity 53. A similar slot 134 is formed longitudinally in arming rotor 54 in a position displaced approximately 120° from longitudinal slot 132. A generally U-shaped spring 136 is inserted into slot 132 in stressed, extended condition. When arming rotor 54 is rotated 120° clockwise as viewed in FIG. 3, slots 134 and 132 will be brought into alignment, and spring 136 will expand into slot 134 thereby preventing further rotation in either direction of arming rotor 54.

Arming rotor 54, best seen in FIG. 10, has formed therethrough a pair of transverse parallel bores 138 and 140. Bore 138 contains a detonator 142 and bore 140 contains a primer 144. A longitudinal bore 146 communicates between bores 138 and 140 and contains a delay composition 148. A transverse bore (not shown) perpendicular to both channel 140 and 146 communicates with a channel 147, shown partially in phantom in FIG. 4, which provides communication between primer 144 and a propellant 152 such as black powder contained in propellant cup 154.

Looking again at FIGS. 2, 10 and 11, a striker plate 156 shown partially broken away to show a firing pin 158 positioned thereunder is suspended thereover by two side legs 157 and a central spring leg 160 formed integrally with striker plate 156. Instantaneous firing pin 158 is retained in position by a shear wire 162 which extends through a lateral hole through pin 158 and is secured to fuze block 13.

On impact with a hard object, striker cup 20 will receive the brunt of the impact and will slide through tubular nose 18 causing rivets 22 to shear. The rearward end of striker cup 20 will be driven against strike plate 156, as best seen in FIG. 11, and will cause spring leg 160 to fold or collapse thereby causing striker plate to pivot about the lower ends of legs 157 and strike firing pin 158. The force of impact will sever shear wire 162 and instantaneous firing pin 158 will be driven into detonator 142 causing initiation thereof. The detonation will be propagated to shaped charge 178 via a mild detonating cord 177 having an end secured in a cavity 176

in fuze block 13 aligned with detonator 142 in its "in line" position.

Impact with a soft surface will not produce sufficient force to overcome shear rivet 22 therefore instantaneous firing pin 158 will not be affected. Instead, a mechanical inertial delay firing mechanism 163 will function. Mechanical inertial delay firing mechanism 163 includes a sleeve 164 having a pair of diametrically opposed helical tracks cut therethrough extending from one end of sleeve 164 to the other end thereof. A cylindrical mass 168 is slidably positioned in sleeve 164 and has a transverse hole 170 drilled through the body of mass 168. Fixed in hole 170 is a follower or pin 172 which extends beyond the peripheral dimension of mass 168 and into helical tracks 166. A second firing pin 174 is formed on the forward end of mass 168. A volute coil spring 175 is positioned forwardly of mass 168 and restrains mass 168 and firing pin 174 from premature forward movement. When the bomb impacts against a soft target, mass 168 will tend to move forward under the influence of inertia but will be forced to revolve about its axis as pin 172 follows helical tracks 166. This arrangement requires that the mass overcome both its translational inertia and its rotational inertia, thereby interposing a short delay of approximately 3 milliseconds between impact of the bomb against the target and the puncture of the primer firing pin 174. When firing pin 174 punctures primer 144, the blast from primer will be directed against and will initiate delay composition 148 and also propellant 152.

In operation, impact with a hard object will cause instantaneous firing pin 158 to be driven into and initiate detonator 142 which will fire through the bore 138 and initiate mild detonating cord 177 leading from cavity 176 to the apex of shaped charge 178 contained in warhead 12, causing instantaneous detonation thereof and producing a shaped charge jet directed against the target. The mechanical inertial delay mechanism 163 will also function, but the 3 millisecond delay forestalls the initiation of the propellant charge until after shaped change 177 has already detonated.

On the other hand impact with a soft target will not affect instantaneous firing pin 158 but instead mechanical inertia delay firing pin 174 will be driven into and initiate primer 144 which will in turn initiate delay composition 148 and also propellant 152 in propellant cup 154. Propellant 152 will explode causing warhead 12 and attached fuze block 13 to be expelled from mortar barrel 14 upward into the air. When delay composition burns down to detonator 142, which takes approximately 100 milliseconds, detonator 142 will be initiated by delay composition 148 and will in turn initiate mild detonating cord 177 which in turn initiates shaped charge 178. When shaped charge 178 explodes, it is approximately 3 to 10 feet above the ground, an optimum height for destructive effect against unprotected personnel. A fragmentation casing 180 enclosing shaped charge 178 will fragment along scores machined in its surface to produce multiple high velocity antipersonnel fragments.

Obviously numerous variations and modifications of the above disclosed embodiment of the present invention are possible in light of the above teachings. For example, in place of the mechanical delay mechanism 163 a 3 millisecond chemical pyrotechnic delay composition could be interposed between the primer and the explosive train leading to the propellant charge. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a dual function bomb having an explosive warhead, a fuze comprising:
- a base;
- a first firing pin supported by said base;
- a second firing pin supported by said base;
- means for actuating said first firing pin upon impact against a hard object;
- inertia actuated means for actuating said second firing pin upon sudden deceleration;
- a propellant disposed to propell the warhead upward;
- first explosive means initiatable by said first firing pin and connected to said warhead for initiation thereof;
- second explosive means initiatable by said second firing pin and communicating with said propellant and said first explosive means for initiation thereof;
- a first delay means for interposing a time delay between impact of the bomb and initiation of said propellant means; and
- a second delay means for interposing a time delay between initiation of said second explosive means and initiation of said first explosive means thereby.

2. The fuze defined in claim 1 wherein:
- said inertia actuated means comprises a cylindrical mass mounted for sliding movement in said base; and
- said first delay means comprises a cylindrical sleeve having defined therein a helical track, said mass being slidably mounted in said sleeve, and a follower connected to said mass and extending into said track for causing the rotation of said mass as it slides in said sleeve.

3. The fuze defined in claim 1 wherein said means for actuating said first firing pin comprises:
- a shiftable impact receiving member disposed in the leading face of said bomb as it falls, and shiftable into operative engagement with said firing pin;
- a frangible member holding said impact receiving member against movement relative to said bomb but severable upon impact with a hard object to permit shifting of said shiftable impact receiving member into operative engagement with said firing pin.

4. The fuze of claim 1 further comprising:
- arming means supported by said base and shiftable between a first position in which the explosive trains of said first and said second explosives are broken, and a second position in which said explosive trains are complete;
- means supported by said base for sensing an environmental condition;
- means interconnecting said sensing means and said arming means to effect said shift from said first to said second position of said arming means when said environmental condition is sensed.

5. The fuze defined in claim 4, wherein:
- said sensing means comprises an oscillating wind vane; and
- said interconnecting means comprises a gear train.

6. The fuze defined in claim 4, wherein

said sensing means comprises a wind vane mounted for rotating oscillation upon a first shaft journaled in said base;

said interconnecting means comprises an eccentric pin connected to said first shaft, a guide disc engaged with said pin for oscillation thereby, a pawl connected to said guide disc for oscillation therewith, a second shaft journaled for rotation in said base, a ratchet wheel keyed to said second shaft for rotation therewith and having teeth formed on the periphery thereof engaged by said pawl for rotation thereby in a reference direction, a second pin fixed to the side of said ratchet wheel, a sprag mechanism engaging said shaft for preventing rotation thereof in the direction opposite to that of said reference direction, a geneva wheel engagable and rotatable by said second pin and connected to said arming means for rotation thereof from said first to said second position.

7. The fuze defined in claim 4, wherein:

said inertia actuated means comprises a cylindrical mass mounted for sliding movement in said base; and

said first delay means comprises a cylindrical sleeve having defined therein a helical track, said mass being slidably mounted in said sleeve, and a follower connected to said mass and extending into said track for causing the rotation of said mass as it slides in said sleeve.

8. The fuze defined in claim 4, wherein:

said means for actuating said first firing pin comprises:

a shiftable impact receiving member disposed in the leading face of said bomb as it falls, and shiftable into operative engagement with said firing pin;

a frangible member holding said impact receiving

member against movement relative to said bomb but severable upon impact with a hard object to permit shifting of said shiftable impact receiving member into operative engagement with said firing pin.

9. The fuze defined in claim 8, wherein:

said inertia actuated means comprises a cylindrical mass mounted for sliding movement in said base; and

said first delay means comprises a cylindrical sleeve having defined therein a helical track, said mass being slidably mounted in said sleeve, and a follower connected to said mass and extending into said track for causing the rotation of said mass as it slides in said sleeve.

10. The fuze defined in claim 6, wherein:

said inertia actuated means comprises a cylindrical mass mounted for sliding movement in said base; and

said first delay means comprises a cylindrical sleeve having defined therein a helical track, said mass being slideably mounted in said sleeve, and a follower connected to said mass and extending into said track for causing the rotation of said mass as it slides in said sleeve;

said means for actuating said first firing pin comprises;

a shiftable impact receiving member disposed in the leading face of said bomb as it falls, and shiftable into operative engagement with said firing pin;

a frangible member holding said impact receiving member against movement relative to said bomb but severable upon impact with a hard object to permit shifting of said shiftable impact receiving member into operative engagement with said firing pin.

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